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Red Pine Cone Production Stimulated by Heavy Thinning

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Cone and seed production of red pine, though related to many factors, is influenced to a great extent by stand density. Binocular counts of the 1961 cone crop in a twice-thinned, 51-year-old red pine plantation show that the percentage of trees bearing cones and the number of cones per tree are directly related to the residual stocking (fig. 1).

The thinning experiment was established the fall of 1951 in a medium-site plantation on the Au Sable State Forest in Crawford County, Mich. This was done in cooperation with the Michigan Department of Conservation. The plantation was planted on an abandoned field in 1912. Original spacing was $4\frac{1}{2} \times 5$ feet. Before thinning, the stand had an average diameter of 5.0 inches and averaged about 180 square feet of basal area per acre. Six thinning compartments were established, and the initial stocking was reduced to residual densities of 60, 80, 100, 120, 140, and 160 square feet. These compartments were rethinned in the fall of 1956 to the same densities.

In all compartments the smallest trees and the poorer quality trees in all size classes were removed until the prescribed stand density was obtained. After the second thinning, all residual trees were in the codominant or dominant crown class except those in the 160-square-foot density compartment where 10 percent were in the intermediate crown class.

In the fall of 1961, rated as a poor seed year for red pine, all trees on one plot in each density level were checked for presence of cones. Total cone counts were made by whorl position on a similar number of cone-bearing trees. These were selected at random by a single observer using binoculars. An accuracy check, after felling several good cone-bearing trees showed that the observer counted 97 percent of the actual number of cones.

The percentage of the trees bearing cones was inversely proportional to the residual basal area in the range of stand densities observed. Ninety-six percent of the trees were bearing cones in the heaviest thinning, but only 19 percent had cones in the lightest thinning (table 1). Figure 1, using the estimated basal area in late July 1959 at the approximate time of flower bud differentiation for the 1961 cone crop, suggests that all trees would probably be bearing cones at lower residual densities.

The greatest number of trees per acre bearing cones occurred at a residual density of 115 square feet, but only two-thirds of all the trees in this level were fruiting. At the higher densities, the few trees with cones generally had small crown openings to the south or west. They also tended to be the larger trees in the stand (table 1). The average diameter of the cone-bearing trees gradually rose above the average stand diameter as the residual basal area increased.

The number of cones per tree and per acre was highest in the most heavily thinned compartments. There was considerable variation in the number of cones per tree within each stocking; apparently small differences in tree spacing can cause big differences in number of cones produced. The most cones occurred on the trees with the larger, better developed crowns, primarily those most released at the first thinning.

Cone location in the crown was only partly related to residual basal area. One-half to two-thirds of the cones were found in the middle one-third of the living crown at residual densities of 60 to 140 square feet. In the 160-square-foot density, only 9 percent of cones were observed in this zone. Few cones occurred in the lower one-third of the crown even at the lowest density. Number of living whorls 10 years after thinning ranged from 22 at 60 square feet to 17 at 160 square feet.

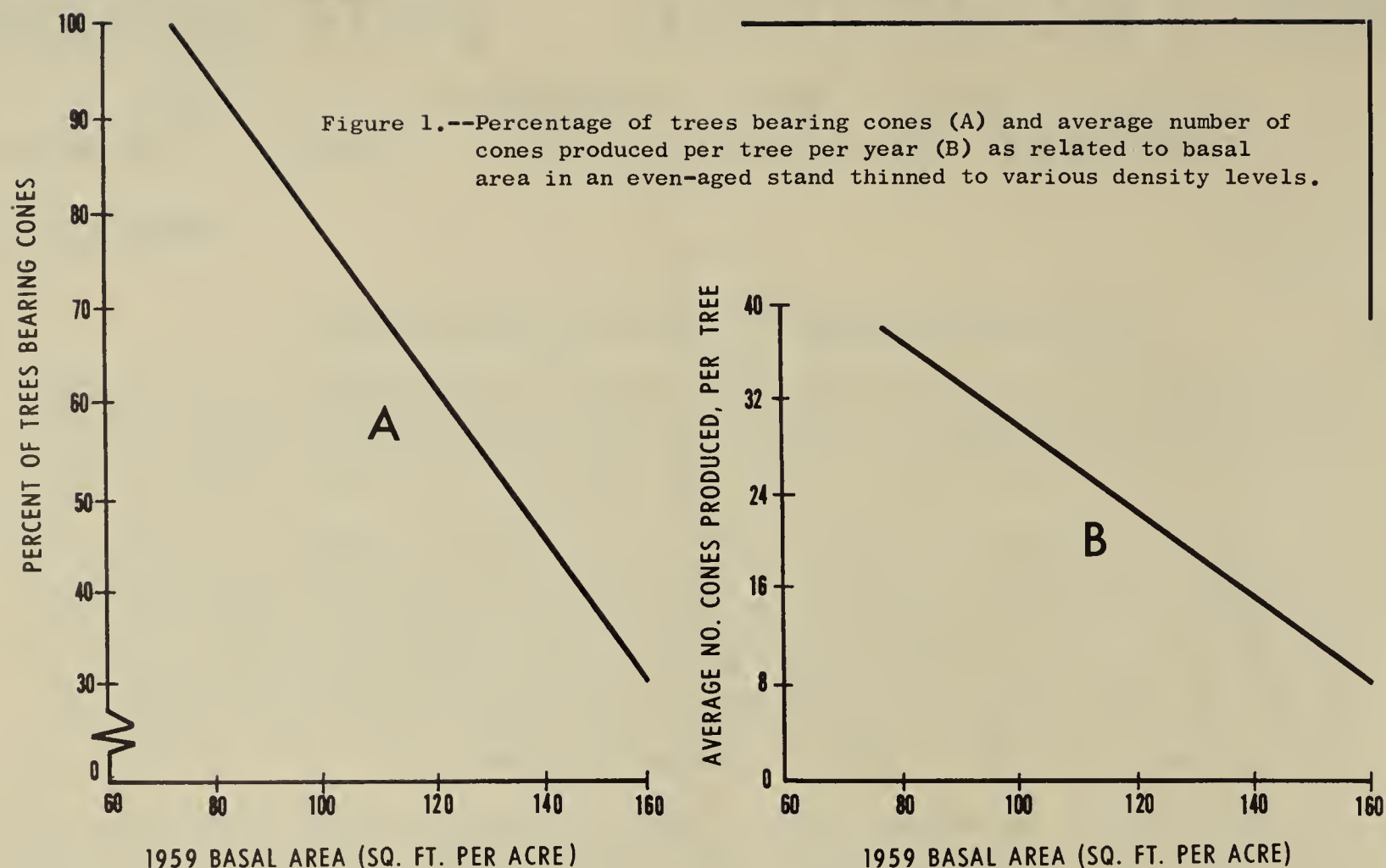


Table 1.--Stand characteristics related to red pine cone production after second thinning

Basal area per acre		All trees			Cone-bearing trees, 1961				
Fall of 1956	1959 ^{1/}	1959 ^{2/} Trees per acre	Average spacing	Average d.b.h. 1961	Trees per acre	Propor- tion of total	Aver- age d.b.h.	Cones per tree	Cones per acre
Sq. ft.	Sq. ft.	No.	Ft.	In.	No.	Percent	In.	No.	No.
67	85	255	13.1	8.4	245	96	8.4	38	9,310
79	95	340	11.3	7.5	269	79	7.7	34	9,146
98	115	440	10.0	7.3	308	70	7.6	14	4,312
118	132	487	9.5	7.3	219	45	8.0	15	3,285
138	154	540	9.0	7.4	189	35	8.2	14	2,646
161	174	900	7.0	6.1	171	19	7.5	2	342

^{1/} Estimated basal area in late July at approximate time of flower bud differentiation for 1961 crop. Includes most of 1959 growing season.

^{2/} The trees per acre and average spacing in 1956 and 1959 were the same as there was no mortality.

Heavy thinning is thus necessary to stimulate cone production in red pine, as the number of cones produced is closely related to residual basal area of the stand at the time of flower bud differentiation. Maximum yield per acre should occur at a residual density of about 80 square feet per acre. Maximum yield per tree, however, should be greater at lower residual densities than those observed in this study. In preharvest release to obtain natural regeneration or in roguing out seed production areas, residual densities should be maintained below 80 square feet to obtain a high-level and more uniform production of cones.